



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/020,047	12/07/2001	Mordechai Rothschild	M0635/7073	4420
23628	7590	12/04/2003	EXAMINER	
WOLF GREENFIELD & SACKS, PC FEDERAL RESERVE PLAZA 600 ATLANTIC AVENUE BOSTON, MA 02210-2211			ROSASCO, STEPHEN D	
			ART UNIT	PAPER NUMBER
			1756	

DATE MAILED: 12/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/020,047

Applicant(s)

ROTHSCHILD ET AL.

Examiner

Stephen Rosasco

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 May 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-48 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 April 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

In response to the Amendment of 11/5/03, wherein independent claims were amended to include the limitation that the attenuation layer is distinct from the phase delay layer, and claims 38-44 were added, the examiner withdraws the prior office action rejections and includes new rejections here.

The examiner indicates here that the French et al. reference was included by error in the last action.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith et al. (5,939,227) or Krivokapic et al. (5,928,813) in view of Mitsui et al. (6,335,124) and Hashimoto et al. (5,958,630).

The claimed invention is directed to a photolithographic mask to transmit light, comprising: a transparent substrate;

a native oxide-free, elemental metal, first layer to attenuate the light; and a second layer to impart a phase delay on the light, one of the first layer and the second layer disposed on the substrate, and the other of the first layer and the second layer disposed on the one of the first layer and the second layer.

The applicant discusses the limitations of the prior art to the use of elemental chrome APSMs, numerous materials have been attempted for use in APSMs, and in particular for use

with deep-ultraviolet light. A variety of composite materials have been suggested, such as chromium oxynitride or molybdenum silicide. Composites have been deposited to form single layer, bilayer, and multilayer APSM structures. And, that while multilayer composite structures have enabled more variations in optical properties, the availability of variations is at the expense of further deposition complexity and increased sensitivity to laser damage.

Smith et al. teach an attenuated phase shift mask for use in lithography at or below 0.20 μm and for use at wavelengths below 300 nm includes a substrate, a first layer disposed on the substrate, and a second layer disposed on the first layer. The first layer is a group IV, V or VI transitional metal nitride and the second layer is Si_3N_4 or the first layer is Si_3N_4 and the second layer is a group IV, V or VI transitional metal nitride.

Krivokapic et al. teach an attenuated phase shift mask comprising a first layer having a thickness to provide a transmission in the range of about 3 to 10% formed on a transparent substrate and a second layer comprising a transparent material having a thickness to provide a desired phase shift and formed on said first layer, said second layer having at least one opening etched therein defined by substantially parabolically profiled walls each said opening also being etched through said first layer.

And wherein said first layer comprises a material selected from the group consisting of metals and metal oxides.

The teachings of Smith et al. or Krivokapic et al. differ from those of the applicant in that the applicant teaches the use of a native oxide-free, elemental metal, first layer to attenuate the light and of hydrogen silsesquioxane as the phase shifter layer.

Mitsui et al. teach a method of manufacturing a halftone phase shift mask blank adapted for the preparation of a phase shift mask comprising the steps of forming a semitransparent film

on a transparent substrate, said semitransparent film being capable of making the phase of light transmitted through said semitransparent film different from that of light transmitted directly through said transparent substrate by a predetermined amount and reducing an intensity of light transmitted through said semitransparent film, wherein the step of forming said semitransparent film comprises a sputtering step using a sputtering target material comprising an element and a compound, said element is selected from the group consisting of metal elements and silicon.

And wherein said element of said sputtering target material is selected from the group consisting of molybdenum, chromium, tungsten, tantalum, cobalt, vanadium, palladium, titanium, niobium, zinc, zirconium, hafnium, germanium, platinum, manganese and iron.

Hashimoto et al. teach a phase shifting mask comprising: a transparent substrate; an opaque film formed on the transparent substrate, such as to have a plurality of opening sections which are arranged to be adjacent to each other; a phase shifter made of hydrogen silsesquioxane, which alternately fills the plurality of opening sections arranged to be adjacent to each other, and is formed on the transparent substrate to have a predetermined film thickness.

And wherein said phase shifter made of hydrogen silsesquioxane is formed to be a mesa type in which the area of the phase shifter occupied at a horizontal surface of an upper surface of the opaque film is larger than that of an upper surface of the phase shifter.

It would have been obvious to one having ordinary skill in the art to take the teachings of Smith et al. or Krivokapic et al. and combine them with the teachings of Mitsui et al. and Hashimoto et al. in order to make the claimed invention because it would be obvious to substitute the claimed metals for those of the prior art and to use silsesquioxane as a phase shifter material given the known benefits of their use.

Application/Control Number: 10/020,047

Page 5

Art Unit: 1756

Applicant's arguments with respect to claims 1-37 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Rosasco whose telephone number is (703) 308-4402.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0661. Fax (703) 872-9310 Before Finals; 872-9311 After Finals.

A handwritten signature in black ink, appearing to read 'S. Rosasco', with a stylized, sweeping underline.

S. Rosasco
Primary Examiner
Art Unit 1756

S. Rosasco
11/26/03